

Original Article

Knowledge Regarding Diet, Physical Activity and Medication among Patients Diagnosed with Type 2 Diabetes Mellitus

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Abstract

Introduction:

Type 2 diabetes mellitus is a highly prevalent disease which is chronic and lifelong and requires a high degree of patient compliance with regard to medication and life style changes. A good knowledge regarding these will be of value. Therefore we aimed to assess the knowledge regarding diet, physical activity and medication in patients diagnosed with type 2 diabetes mellitus attending the diabetes clinic, Teaching Hospital Peradeniya.

Methods:

This is a descriptive, cross sectional study, recruited 400 outpatients attending the diabetes clinic at Teaching hospital Peradeniya. The knowledge regarding diet, physical activity and medication among type 2 diabetes mellitus patients was assessed using an interviewer administered questionnaire.

Results:

half the sample had a good level of knowledge regarding dietary recommendations, with younger age group ($p < 0.05$), females ($p < 0.001$) and a high level of education ($p < 0.005$) having better knowledge. A good knowledge regarding physical activity was observed only in 20.8%, with high scores observed in males below 50 years of age with a high education level ($p < 0.05$). 78.0% of the participants had a good knowledge about medication, with males ($p < 0.01$) and patients with longer disease duration had a significantly higher level of knowledge ($p < 0.005$). Males had a slightly higher mean percentage total score (70.5188) than the females (69.8588) however the difference was not significant.

Conclusion:

knowledge levels are satisfactory with regard to diet and medication, however more detailed knowledge regarding recommended food groups are needed. Knowledge on physical activity is not complete and needs attention.

Keywords: Diabetes mellitus, Risk factors, Physical activity, Diet, Exercise

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Introduction

Diabetes mellitus (DM) is a serious, chronic metabolic disease, characterized by high blood glucose levels over a prolonged period of time. Type 2 diabetes mellitus, the commonest form is non-insulin dependent and can be controlled with medication and life style modifications. It occurs due to insulin resistance in which cells fail to respond to insulin properly.

It is estimated that 422 million people worldwide have diabetes, with the majority living in low- and middle-income countries^[1]. The total number of adults with diabetes is predicted to rise to 643 million by 2030

and 783 million by 2045^[2]. North America and the Middle Eastern countries have the highest number of people suffering from diabetes^[3].

The situation in Sri Lanka is invariably the same, with a definite upward trend in the prevalence of DM. The crude prevalence of diabetes in adults is reported to be as high as 23.0%, while the prevalence of pre-diabetes is at an alarming 30.5%^[4]. Diabetes prevalence was seen to increase with age until ages ≥ 70 years and was more prevalent in female, urban, more affluent, and Muslim adults^[4]. Diabetes and pre-diabetes prevalence was seen to increase with body mass index (BMI) but was as high as 21% and 29%, respectively, in those of normal weight as well^[4].

Diabetes risk factors of Sri Lanka have been identified as 39 % of physical inactivity, 31.7% of increased waist, family history 26.2% and 20.9% due to increased BMI^[5]. While family history is a non-modifiable risk factor, clearly physical activity and dietary changes can be modified to achieve better control.

Dietary guidelines & nutritional therapy for specific diseases published by Ministry of Health Sri Lanka, gives exact guidelines on dietary management of DM for weight management while maintaining appropriate body mass index and prevention or delaying other complications of diabetes^[6]. An estimated 500 million people are said to develop noncommunicable diseases including diabetes due to physical inactivity, between 2020 and 2030^[7,8]. It is recommended that people with DM should engage in physical activity regularly and be encouraged to reduce sedentary time and break up sitting time with frequent activity breaks^[9].

While this information is widely known and freely available to the health care workers, how much of it has filtered down to the general public. Lack of knowledge regarding DM and its complications among diabetic patients has been highlighted in some studies in other parts of the country^[10].

Even though several studies have been done with regard to dietary habits of patients diagnosed with diabetes, studies which look at several aspects of DM control were not forthcoming. Therefore, this study attempts to assess the knowledge regarding diet, physical activity, medication, and glucose testing in patients diagnosed with type 2 DM attending the diabetic clinic of Teaching Hospital Peradeniya (THP) Sri Lanka.

Methodology

This descriptive, cross-sectional study, was conducted at the Faculty of Medicine, University of Peradeniya and Teaching Hospital Peradeniya. Patients attending the outpatient diabetic clinic of the Teaching Hospital Peradeniya, were recruited. Prior permission was taken from all concerned authorities and ethical clearance was granted by the institutional ethics committee.

Sample size was calculated using the standard sample size calculation formula for cross sectional studies^[11]. Ten percent of the sample size is added to obtain the final value arriving at a sample size of 400.

Patients with a definitive diagnosis of type 2 diabetes mellitus, registered in the clinic for longer than 3 months were recruited for the survey. Patients who could not understand Sinhalese or English, patients who were severely ill and who were mentally unsound, were excluded. The independent variables were age, sex, duration of disease (calculated considering the date of diagnosis) and the educational level of the participant, while the dependent variable was the knowledge score.

An interviewer administered questionnaire was prepared using the guidelines of the American Diabetes Association and Sri Lanka Diabetic Guidelines, under the supervision of a consultant physician. It was pretested on 30 patients in the diabetes clinic of Teaching Hospital Peradeniya and the questionnaire was reformulated according to the information gathered from their answers.

The questionnaire included demographic details, and consisted of 18 close and open-ended questions, assessing the knowledge on diet, physical activity and medication.

The investigators visited the diabetic clinic on conservative days until the sample size was achieved. The first patient was selected randomly, using an online number generator for the clinic numbers. and thereafter, every second patient in the clinic number order was recruited until the sample size of 400 was reached. Written, informed consent was obtained and no data was collected on those who refused to participate. Each patient was interviewed with the questionnaire, in either Sinhala or English according to his or her preference.

Data was entered to Microsoft Excel spreadsheet and the data was exported to IBM SPSS 20 for analysis. Each correct answer in the questionnaire was given 1 mark. Answers marked as 'Don't know' were coded as '0'. Depending on the extent of the wrong answer it was coded -2, -3 and -4; -4 being the most unsuitable answer. The final percentage score in each category was obtained by adding up the total marks awarded for each question. A score above 75% was considered as a good knowledge level. A score between 50 – 75% was considered as moderate and lower than 50% was considered as poor knowledge. Descriptive statistical measures such as frequency of responses, mean and standard deviation of each response in each subtopic were calculated. Analytical statistics were performed using ANOVA–Analysis of Variance, to compare the level of knowledge in the three categories, with the age, gender, duration of disease and educational level.

Results

Descriptive statistics

Socio-demographic characteristics of the patients are presented in Table 1.

Table 1: Socio-demographic details of the patients

Socio-demographic characteristics	Frequency	Percentage
Sex		
Male	195	48.75%
Female	205	51.2%
Total	400	100%
Age (years)		
30-40	17	4.3%
41-50	56	14.0%
51-60	122	30.5%
61-70	156	39.0%
71-80	47	11.8%
81-90	2	0.5%
Total	400	100.0%
Education level		
Below Grade 5	2	0.5%
Grade 5	45	11.3%
Grade 8	67	16.8%
O/L	179	44.8%
A/L	91	22.8%
Degree	16	4.0%
Total	400	100.0%
Duration of disease (years)		
1 – 10	251	62.8%
11 – 20	115	28.8%
21 – 30	29	7.3%
31 – 40	5	1.3%
Total	400	100.0%

The mean age of the patients was 59.65 years (SD=9.971), with a minimum age of 30 years and maximum age of 85 years. The highest number of patients was from age group 61 – 70 years. Majority of the patients had an education level up to GCE O/L (44.8%). An education level up to A/L and above was considered as a 'good education' and education level of O/L and below was considered as a 'inadequate education'. Most of the patients have had the disease for 1 – 10 years with a mean of 9.65 years (SD = 7.442).

Knowledge scores were calculated out of 100 for all three disease controlling factors (diet, physical activity and medication) and a total knowledge score was calculated combining the three scores. The knowledge score was categorized into 3 knowledge levels as: Good knowledge (above 75%), Moderate knowledge (50% – 74%) and Poor knowledge (less than 49%). The total knowledge levels are depicted in table 2 while knowledge levels in dietary recommendations, physical activity and medications are shown in table 3.

Table 2: Distribution of the total knowledge score

Level of knowledge	Frequency	Percentage
Good knowledge	130	32.5%
Moderate knowledge	254	63.5%
Poor knowledge	16	4.0%
Total	400	100.0%

Majority of the study population (254) had a moderate knowledge score. The mean total score obtained was 70.0156 (SD = 10.89083) with the minimum score being 36.82 and the maximum being 100.00.

Table 3: Level of knowledge regarding dietary recommendations, physical activity, and medication

	Frequency	Percentage
Knowledge regarding diet - Mean score – 72.61 (SD=16.88)		
Good knowledge	202	50.5
Moderate knowledge	169	42.3
Poor knowledge	29	7.3
Knowledge regarding physical activity - Mean score 52.25. (SD = 22.230)		
Good knowledge	83	20.8%
Moderate knowledge	122	30.5%
Poor knowledge	195	48.8%
Level of knowledge about medications - Mean score - 85.1831 (SD = 15.28153)		
Good	312	78.0
Moderate	79	19.8
Poor	9	2.3

Knowledge regarding diet

With regard to individual food items a majority (65.3%) stated that non-fat milk was preferable while most (73.3%) stated that cooking with second extract of coconut milk or water was preferred, while 13.3% stated that it was not preferable. Of the patients, 332 (83.0%) said that cooking with oil was not good, while 43.5% knew that unsaturated fats were preferred, while 42.8% were did not know the answer. 54.3% said that foods with saturated fats were not suitable.

Majority (96.0%) knew that whole grains were preferred as a carbohydrate source and that refined carbohydrates were not suitable (94%). Of the patients, 89% stated that non starchy vegetables were better and all most all patients (94%) stated that fruits were better as a snack and that fried snacks and pastries were not bad. While 64% said that sugarless biscuits were suitable, 90% said that any kind of biscuit was not recommended. Nearly all the participants (390 out of 400) stated that beverages with added sugar were bad. Only 27.0% of the subjects stated that fish consumption was preferable, while only 44.0% said that the preferred amount of salt per day was less than a teaspoon.

Knowledge regarding physical activity

A majority of patients (92.0%) knew that a diabetic patient should engage in aerobic exercises such as brisk walking, bicycling, dancing, stair climbing, jogging, running, hiking and gardening. However, a majority 272 (68%) did not know that aerobic exercises should be done for 30 minutes at least 5 days a week or a total of 150 minutes of exercise per week. Among the patients, 131(32.8%) stated that the intensity of aerobic exercises should be to an extent to which you do not feel tired. Out of the sample 285 patients (71.3%) knew that a diabetic patient should lift objects such as water buckets, do heavy gardening, weight machines or free weights at the gym, however, 115 participants (28.8%) stated that a diabetic patient should not engage in heavy activities. Out of the participants 68.3% did not know that a diabetic patient should engage in strength training activities at least 3 days per week.

Knowledge regarding medication

Out of the patients, 83.5% were on oral medication, while 28 patients took insulin only and 9.3% were on both. Of patients on oral medications, 76.0% were aware of the correct dose of the oral drug. Out of the sample, 282 patients (70.5%) knew that they should not miss doses, however 15.0% (60) were under the impression that it was alright to miss a dose daily. Out of those on insulin 98.5% knew the correct dose and all most all (92.3%) stated that insulin should be stored in a refrigerator or a clay pot. Majority (86%) knew the correct method of monitoring blood glucose levels, however, five patients had the wrong idea and 55 (13.8%) patients did not know the method.

Relationship between demographic factors and the knowledge level

The relationship between level of knowledge regarding dietary recommendations, physical activities and medication with age, gender, education level and duration of disease is presented in table 4.

Dietary recommendations

The knowledge regarding dietary recommendations was higher in the younger age groups and the observed difference was statistically significant. ($p < 0.050$) The highest mean percentage score (78.6096, SD = 17.21617) was observed in ages 31 – 40, whereas the lowest was in ages 81 – 90 (Mean = 38.6364, SD = 9.64237). A good mean knowledge score was observed in females (74.4858, SD = 15.98654) rather than in males (66.6029, SD = 18.31153). There was a significant statistical difference in the knowledge scores between males and females ($p < 0.001$). The highest (Mean = 79.6238, SD = 18.68700) and lowest (Mean = 71.2648, SD = 16.63635) mean percentage scores for knowledge on dietary recommendations among patients were observed from the participants who have had the disease for 21 – 30 years and 11 – 20 years respectively. There was no statistically significant difference between the results from each disease duration category ($p > 0.05$). The patients with a degree had the highest mean score of 76.1364 (SD = 16.55611), while the lowest mean score was from the patients who had an education below Grade 5 (Mean = 63.6364, SD = 19.28473) The observed difference was statistically significant ($p < 0.005$) (Table 4).

Physical activity

Young participants (age 50 years and below) had a higher mean score (58.75) than old participants (age 51 and above) (51.01). However the difference of knowledge score with the age was not statistically significant (table 4). A good knowledge score was

Table 4: Relationship between knowledge regarding diet, physical activities and medication with age, gender, disease duration and education level

Knowledge regarding	Diet			Physical activities			Medication		
Age (n)	Sum of squares = 19505.513; df = 48; P value = 0.020			Sum of squares = 681.612; df = 5; P value = 0.232			Sum of squares = 12906.280; df = 48; P value = 0.208		
	Good n (%)	Moderate n (%)	Poor n (%)	Good n (%)	Moderate n (%)	Poor n (%)	Good n (%)	Moderate n (%)	Poor n (%)
30 – 40 (17)	12(70.6%)	4 (23.5%)	1 (5.9%)	5 (29.4%)	7(41.2%)	5(29.4%)	15(88.2%)	2(11.8%)	0 (0%)
41 – 50 (56)	32(57.1%)	20(35.7%)	4 (7.1%)	11(19.6%)	20(35.7%)	25(44.6%)	53(94.6%)	3(5.4%)	0 (0%)
51 – 60 (122)	64 (52%)	52(42.6%)	6 (4.9%)	29(23.8%)	38(31.1%)	55(45.1%)	90(73.8%)	29(23.8%)	3(2.5%)
61 – 70 (156)	71(45.5%)	74(47.4%)	11 (7.1%)	30(19.2%)	43(27.6%)	83(53.2%)	116(74.4%)	35(22.4%)	5(3.2%)
71 – 80 (47)	23(48.9%)	19(40.4%)	5 (10.6%)	8 (17%)	14(29.8%)	25(53.2%)	37(78.7%)	9(19.1%)	1(2.1%)
81 – 90(2)	0 (0%)	0 (0%)	2 (100%)	0 (0%)	0 (0%)	2 (100%)	1(50%)	1(50%)	0(0%)
Gender(n)	Sum of squares = 19505.513; df = 48; P value = 0.020			Sum of squares = 0.832; df = 5; P value = 0.471			Sum of squares = 1524.338; df = 1; P value = 0.01		
	Good n (%)	Moderate n (%)	Poor n (%)	Good n (%)	Moderate n (%)	Poor n (%)	Good n (%)	Moderate n (%)	Poor n (%)
Male(95)	32(33.7%)	52 (54.7%)	11(11.6%)	24(25.3%)	28(29.5%)	11(11.6%)	79 (83.2%)	14(14.7%)	2(2.1%)
Female (305)	170(55.7%)	117(38.4%)	18 (5.9%)	59(19.3%)	94(30.8%)	18 (5.9%)	233(76.4%)	65(21.3%)	7(2.3%)
Duration of disease (n)	Sums of squares - 8366.993; df = 33; P value = 0.660			Sum of squares = 259.835; df = 5; P value = 0.456			Sum of squares = 11993.316; df = 33; P value = 0.017		
	Good n (%)	Moderate n (%)	Poor n (%)	Good n (%)	Moderate n (%)	Poor n (%)	Good n (%)	Moderate n (%)	Poor n (%)
01 – 10 (251)	129(51.4%)	105(41.8%)	17 (6.8%)	51(20.3%)	71(28.3%)	129(51.4%)	197(78.5%)	48(19.1%)	6(2.4%)
11 – 20 (115)	50 (43.5%)	55 (47.8%)	10 (8.7%)	22(19.1%)	41(35.7%)	52(45.2%)	86(74.8%)	28(24.3%)	1(0.9%)
21 – 30 (29)	20 (69%)	7 (24.1%)	2 (6.9%)	8(27.6%)	9(31%)	12(41.4%)	24(82.8%)	3(10.3%)	2(6.9%)
31 – 40(5)	3 (60 %)	2 (40%)	0 (0%)	2(40%)	1(20%)	2(40%)	5(100%)	0(0%)	0(0%)
Education (n)	Sums of squares - 4748.940; df = 5; P value = 0.005			Sum of squares = 15.769; df = 5; P value = 0.025			Sum of square = 2.278; df = 5; P value = 0.076		
	Good n (%)	Moderate n (%)	Poor n (%)	Good n (%)	Moderate n (%)	Poor n (%)	Good n (%)	Moderate n (%)	Poor n (%)
Below Grade 5(2)	1 (50%)	1 (50%)	0 (0%)	0(0%)	1(50%)	1(50%)	1(50%)	1(50%)	0(0%)
Up to Grade 5 (45)	15 (33.3%)	25 (55.6%)	5 (11.1%)	4(8.9%)	11(24.4%)	30(66.7%)	34(75.6%)	8(17.8%)	3(6.7%)
Up to Grade 8(67)	26 (38.8%)	34 (50.7%)	7 (10.4%)	14(20.9%)	20(29.9%)	33(49.3%)	50(74.6%)	14(20.9%)	3(4.5%)
O/L (179)	95 (53.1%)	76 (42.5%)	8 (4.5%)	35(19.6%)	59(33%)	85(47.5%)	138(77.1%)	39(21.8%)	2(1.1%)
A/L (91)	55 (60.4%)	28 (30.8%)	8 (8.8%)	25(27.5%)	27(29.7%)	39(42.9%)	79(86.8%)	12(13.2)	0(0%)
Degree (16)	10 (62.5%)	5 (31.2%)	1 (6.2%)	5(31.2%)	4(25%)	7(43.8%)	10(62.5%)	5(31.2%)	1(6.2%)

observed in males (25.3%) rather than in females (19.3%). The mean percentage score for males (55.37, SD = 20.926) was slightly higher than females (51.28, SD = 22.566). Observed difference was statistically significant. ($p < 0.05$). Patients who had the disease for 1 – 10 years have the highest percentage of a ‘poor knowledge’ on physical activity (51.4%). The highest mean score percentage was observed in the patients who have the disease for 31 – 40 years (Mean = 60.00, SD = 20.000). The patients with duration of the disease for 1 – 10, 11 – 20, 31 – 40 had mean scores of 51.71 (SD = 21.869), 52.52 (SD = 21.433), 54.48 (SD = 28.734). However the difference of the knowledge score with duration of the disease was not statistically significant (Table 4).

Medication

Most of the patients from each age category had a good knowledge. The highest mean percentage score was from ages 41 – 50 (Mean = 91.4643, SD = 11.13184) while the lowest was from 81 – 90 (Means = 76.6000, SD = 33.09260). However the level of knowledge on medication with age was not statistically significant. ($p > 0.05$).

The male patients had a higher mean score (Mean = 88.6809, SD = 14.93469) than females (Mean = 84.0936, SD = 15.24859) and the observed difference was statistically significant. ($p < 0.01$) (Table 4)

Of the patients, 82.8% who had the disease for 21 – 30 years had a good knowledge score with a mean of 86.8020 (SD = 20.37392) and all patients who had the disease for 31 – 40 had a good knowledge score (100%) with the highest mean score of 89.2800 (SD = 8.91471). There was a significant statistical difference in the scores from different disease duration groups ($p < 0.05$) (Table 4).

Over 85% of the patients with an educational level up to A/L had a good knowledge (Mean = 88.0000, SD = 12.22273). One patient with a degree had poor knowledge and the difference in knowledge score with educational level was not statistically significant ($p > 0.05$) (Table 4).

Discussion

Our sample showed the same characteristic of a typical diabetic patient in Sri Lanka. Mean age was 59.65 years, compatible with Sri Lankan health statistics^[12]. Majority of the participants of our study had an education level up to O/L (44.8%). The report of National Survey on Self-Reported Health in Sri Lanka showed that the prevalence of diabetes was markedly high in the least educated groups (<Grade 5) within the working age population^[12]. Other researchers report similar findings^[13,14,15]. Higher level of education seen in our sample maybe due to the fact that the drainage area of the Peradeniya hospital is mostly urban.

The primary goal in the management of diabetes is regulation of blood glucose to achieve near normal levels. As dietary control is a crucial factor in controlling the disease, a good knowledge on diet enhances the proper management of the disease. A balanced diet should consist of rice (preferably high fibre, red rice), vegetables, fruit, meat such as chicken, fish and non-fat dairy products^[6]. Carbohydrates account for 71.2% of the energy requirement in a Sri Lankan adult^[16]. Almost all of our study participants had an adequate knowledge about preferred carbohydrate sources. Reports from the National Hospital of Sri Lanka are similar with a majority of the study population recognizing that red rice and long grain rice varieties are good for diabetic patients^[17]. Researchers from other countries too report that a majority of diabetic patients are aware of the carbohydrates recommended and those that need to be avoided.

Fruit in general has a varying Glycaemic Index. Consuming fruits with lower Glycaemic Index decreases HbA1C^[18]. Majority of our sample stated that fruit was a good snack. In contrast reports from National Hospital of Sri Lanka, most of their study sample believed that fruit were not suitable^[17]. Proper information regarding fruit consumption is mandatory and can improve the control of blood sugar and provide a much needed sweet treat for patients improving their quality of life.

A fact of concern was that only 43.5% of our patients knew that unsaturated fats such as olive oil, sesame oil and sunflower oil were preferred, to other oils. Eighty percent of the fat intake in Sri Lankans is from coconut which is high in saturated fatty acids^[19]. However, 70.3% of the patients said that cooking with first extract of coconut milk was not recommended and also knew that cooking with coconut oil was not healthy. Even though the knowledge is not complete patients are aware that fat is also a nutrient that diabetics should be concerned about. Improving the knowledge regarding other fat sources and the recommended amounts would prevent DM patients from developing other non-communicable diseases and ensure better control and delaying complications.

Full cream milk consumption can increase the risk of Type 2 DM^[20]. Majority of our sample were aware that full cream milk was not suitable, and that non-fat milk was preferable.

Preferred amount of salt was correctly stated as one teaspoon (2300mg) or less, only by 44.0% of the subjects. Half of the study population (50.0%) did not know the correct amount of salt recommended. Since people are advised to use salt according to taste while cooking, they may not know the exact recommended salt amount. Most patients were of the opinion that salt intake need to be restricted only if they had hypertension.

Among the study population, a majority had a good to moderate knowledge score for diet, while only 7.3% had a poor knowledge score. Younger patients had better knowledge about diet than the older participants.

A Malaysian, study reports that the knowledge score in nutrition was higher in adults than in the elderly^[21]. The knowledge score for diet increased when the patient's education level was higher. Similarly in the study conducted in Malaysia, participants with formal education had a higher knowledge score in nutrition, than the participants without a formal education^[21].

A study done some years back at Teaching Hospital Peradeniya reports that patients consumed an energy restricted "high carbohydrate and low-fat diet" compared to other Asian and western diabetic populations, while protein and fat intake were predominantly plant origin and that patients have exceeded the recommended amount of starch per day^[22].

The females had a better knowledge about diet than males. This is understandable since females are more concerned with dietary matter and are generally the cooks of the family and prepare meals on a daily basis.

Further, majority of patients who had, had the disease for over 20 years had a good knowledge regarding diet.

Umpierre et al (2011) reports that engaging in structured exercises for more than 15 minutes per week, reduces HbA1C level and anything less does not^[23]. Further, aerobic exercises and strength training exercises in combination reduces HbA1C levels more effectively^[24]. Even though all most all of our subjects knew that a diabetic patient should engage in aerobic exercises most were unaware of the duration of the aerobic exercises. Further, only 24.8% knew that a diabetic patient should engage in 30 minutes of exercise at least 5 days a week / total of 150 minutes of exercise per week. Reports from a study done in Moratuwa district hospital, states that 40.0% of the patients were unaware that regular exercise was needed in controlling type 2 diabetes^[13]. Older patients and females were more likely to be unaware of the recommended frequency and duration of physical activity, while the younger male patients with a higher education level had a much better knowledge. A similar research study done in Batticaloa district had shown that as a disease controlling factor, the knowledge of enhancing physical activity was significantly related with their education level^[25]. In a research study in China also showed that patients with a higher education level had a higher knowledge regarding physical activity^[26].

In a study conducted to assess the knowledge and perception about diet and physical activity among Sri Lankan adults with diabetes mellitus, all participants were aware about the importance of dietary control in the management of diabetes mellitus but adherence to practices were poor due to social circumstances^[27].

Around three fourth of subjects had good level of knowledge about medications. Most subjects were on oral medication, while small percentage used insulin only and others were on both tablets and insulin. These findings were consistent with those of Moodley and Rambiritch (2007) and Kisokanth (2014) who found that a majority used oral medication alone, and only small percentages of patients used insulin and both types of medication^[25,28].

Among those who used tablets, more than 80% were aware of correct daily dose while among those who used insulin, almost all were aware of the dose of insulin they used. All most all were also aware of the correct method of insulin storage. However, Kisokanth et al (2014) in their study done in General Hospital Batticalo found that only 57% of those on oral medication knew the correct dose and only 44.61% knew the dose of insulin they used^[25]. This discrepancy in results may be due to the fact that Kisokanth's sample being from a more rural population than ours. Of our patient 78% had a good knowledge regarding aspects of medication while and patients between the ages of 41-50 years had the highest mean percentage score while age of 81-90 had the lowest mean

percentage score. However, there was no significant relationship between the levels of knowledge on medication and age. These results were consistent with that of Moodley and Rambiritch (2007) where the best scores were in the 40-59 age group and the worst were between the ages of 60-79 years^[28]. Male patients had a significantly higher mean score in knowledge regarding medication than their female counterparts in our study group.

A significant relationship between the duration of the disease and the knowledge on medication was observed in our patients. Other studies too show that with the increase in age of years post diagnosis, there is a progressive increase in the number of patients passing the diabetes knowledge test^[25,28]. Surprisingly we could not demonstrate a significant relationship between education level and knowledge regarding medications. This result was consistent with those of Perera et al (2013) who found that those with literate or primary level of education did not show any significant difference in mean knowledge score compared to those with secondary education^[13]. Since the mean knowledge score on knowledge regarding medication was good this means that even those with a lower level of education had a good knowledge regarding the medication they were on.

It was satisfying to see that a majority were aware on how and when to test blood glucose levels and also when to attend clinics and continue the treatment. Majority stated that they should be given the chance to discuss the disease condition with the doctor at any time even though they understood the practical difficulties in doing this in a busy clinic setting.

The overall knowledge score in our patients was satisfactory with 96% scoring between 50 – 74 marks with a mean score of 70. It was consistent with the results of a similar study conducted in a primary care level hospital in Moratuwa, which showed a percentage mean score of 68.1%^[13]. Highest proportion of subjects with a good knowledge score was observed in the 41-50 age group, similar to reports from South Africa^[28]. When it comes to gender mixed results are reported with some studies showing males to have better knowledge and others stating that females were better^[25,28]. Two studies further show similar results to ours with progressive increase in the mean knowledge score with increasing duration of the disease^[13,28].

The highest mean score we observed was in a patient with a degree, and the proportion of subjects with a good knowledge was high in higher education levels, and this association was statistically significant. Kisokanth et al (2014) has also shown that the age and educational level has a significant association with higher knowledge^[25].

Being a lifelong chronic disease DM requires a high level of self-care in order to prevent or delay complications. Lack or gaps in knowledge regarding diabetic control can have severe consequences to the overall quality of life of the patient. Even though we report a good overall knowledge level several knowledge gaps were identified and require attention by health administrators when designing and implementing awareness among patients.

Conclusion

While Overall knowledge levels are satisfactory, patients' knowledge regarding the type of fat that is safe, the correct duration and type of exercise recommended, correct recommended amount of salt per day, importance of including fish in the diet were poor. Male patients should be educated about the diet recommendations while female should be educated regarding physical activity and medication.

References

1. Diabetes World Health Organisation. Available from <https://www.who.int/health-topics/diabetes#tab=tab>. [Accessed 4th September 2024].
2. Diabetes now affects one in 10 adults worldwide. *International Diabetes Federation*. (2021). Available from <https://idf.org/news/diabetes-now-affects-one-in-10-adults-worldwide/>. [Accessed 4th September 2024].
3. We should be worried about global diabetes rates. This chart shows why. World Economic Forum. *Health and Healthcare systems*. (2021). Available from <https://www.weforum.org/agenda/2021/11/-diabetes-burdens-rising-health-global/>.
4. Rannan-Eliya RP, Wijemuni N, Perera P, Kapuge Y, Gunawardana N, et al. SLHAS Collaborators. Prevalence of diabetes and pre-diabetes in Sri Lanka: a new global hotspot-estimates from the Sri Lanka Health and Ageing Survey 2018/2019. *BMJ Open Diabetes Res Care*. 2023;11(1):e003160. doi: 10.1136/bmjdc-2022-003160. PMID: 36796852; PMCID: PMC9936281.
5. Diabetic association of Sri Lanka. Risk factors. Available from <https://www.diabetessrilanka.org/living-with-diabetes/risk-factors/> [Accessed 4th September 2024].
6. Dietary Guidelines and Nutritional therapy for specific diseases. Nutritional division, Ministry of Health. Available from <https://nutrition.health.gov.lk/wp-content/uploads/2020/12/Disease-based-Dietary-guidelines-> [Accessed 4th September 2024].
7. WHO highlights high cost of physical inactivity in first-ever global report (2022) Available from <https://www.who.int/news/item/19-10-2022-who-highlights-high-cost-of-physical-inactivity-in-first-ever-global-> [Accessed 4th September 2024].
8. Eaton SB, Eaton SB. Physical Inactivity, Obesity, and Type 2 Diabetes: An Evolutionary Perspective. *Res Q Exerc Sport*. 2017;88(1):1-8. doi: 10.1080/02701367.2016.1268519. Epub 2017 Jan 27. PMID: 28129048.
9. Kanaley JA, Colberg SR, Corcoran MH, Malin SK, Rodriguez NR, et al. Exercise/Physical Activity in Individuals with Type 2 Diabetes: A Consensus Statement from the American College of Sports Medicine. *Med Sci Sports Exerc*. 2022;54(2):353-368. doi: 10.1249/MSS.0000000000002800. PMID: 35029593; PMCID: PMC8802999.
10. Herath HMM, Weerasinghe NP, Dias H, Weeraratna TP. (). Knowledge, attitude and practice related to diabetes mellitus among the general public in Galle district in Southern Sri Lanka: a pilot study. *BMC Public Health*. 2017;17:535. doi: 10.1186/s12889-017-4459-5.
11. Lwanga, Stephen Kaggwa, Lemeshow, Stanley & World Health Organization. (1991). Sample size determination in health studies : a practical manual / S. K. Lwanga and S. Lemeshow. *World Health Organization*. <https://iris.who.int/handle/10665/40062>
12. Department of Census and Statistics, Ministry of national Policies and Economic Affairs, 2016. (cited 2024 September). Available from <http://www.statistics.gov.lk/Resource/en/Health/DemographicAndHealthSurveyReport-2016-Contents.pdf>
13. Perera DP, De Silva REE, Perera WLSP. Knowledge of diabetes among type 2 diabetes patients attending a primary health care clinic in Sri Lanka. *East Medit Heal Jol; Alexandria*. 2013;19(7): 644-648.
14. Jason, M.F. and David E.F. (2012). Higher Education and Health Investments: Does More Schooling Affect Preventive Health Care Use? *Jo Hum Cap*. 3(2): 144-176.
15. Sabates R, Feinstein L. The role of education in the uptake of preventative health care: the case of cervical screening in Britain. *Soc Sci Med*. 2006;62(12):2998-3010. doi: 10.1016/j.socscimed.2005.11.032. PMID: 16403597.
16. Jayawardena R, Thennakoon S, Byrne N, Soares M, Katulanda P, Hills A. Energy and nutrient intakes among Sri Lankan adults. *Int Arch Med*. 2014 Jul 11;7:34. doi: 10.1186/1755-7682-7-34. PMID: 25067954; PMCID: PMC4110527.
17. Breen C, Ryan M, Gibney MJ, O'Shea D. Diabetes-related nutrition knowledge and dietary intake among adults with type 2 diabetes. *Br J Nutr*. 2015;114(3): 439-447. [cited 2024 September 6th]. Available at: <https://www.ncbi.nlm.nih.gov/pubmed/26169113>
18. Jenkins DJ, Srichaikul K, Kendall CW, Sievenpiper JL, Abdunour S, et al. The relation of low glycaemic index fruit consumption to glycaemic control and risk factors for coronary heart disease in type 2 diabetes. *Diabetologia*. 2011;54(2):271-9. doi: 10.1007/s00125-010-1927-1. Epub 2010 Oct 27. PMID: 20978741; PMCID: PMC3017317.
19. Amarasingiri WA, Dissanayake AS. Coconut fats. *Ceylon Med J*. 2006 Jun;51(2):47-51. doi: 10.4038/cmj.v51i2.1351. PMID: 17180807.
20. Eussen SJ, van Dongen MC, Wijckmans N, den Biggelaar L, Oude Elferink SJ, et al. Consumption of dairy foods in relation to impaired glucose metabolism and type 2 diabetes mellitus: the Maastricht Study. *Br J Nutr*. 2016;115(8):1453-61. doi: 10.1017/S0007114516000313. Epub 2016 Feb 24. PMID: 26907098.

21. Ju LC, Shahar S, Yahya HM, Ching TS, Nor SMN, Chuo LH, Zaki MFM, Salehuddin D, Mukhsan N. Level of nutritional knowledge and health awareness among diabetes mellitus patients at cheras health clinic, Kuala Lumpur, Malaysia. *Sains Malaysiana*. 2010;**39** (3): 505-511.
22. Medagama A, Fernando D, Widanapathirana H. Energy and nutrient intakes of Sri Lankan patients with type 2 diabetes mellitus: a cross-sectional survey. *BMC Res Notes*. 2015 Dec 8;**8**:753. doi: 10.1186/s13104-015-1732-5. PMID: 26645275; PMCID: PMC4673754.
23. Umpierre D, Ribeiro PAB, Kramer, CK. Physical Activity Advice Only or Structured Exercise Training and Association with HbA1c Levels in Type 2 Diabetes: A Systematic Review and Meta-analysis. *JAMA*. 2011;**305** (17): 1790-1799. doi:10.1001/jama.2011.576.
24. Church TS, Blair SN, Cocroham S. Effects of Aerobic and Resistance Training on Hemoglobin A1c Levels in Patients With Type 2 Diabetes A Randomized Controlled Trial. *JAMA*. 2010;**304** (20): 2253-2262. doi:10.1001/jama.2010.1710
25. Kisokanth G, Prathapan S, Indrakumar J, Joseph J. Patients with diabetes mellitus in a tertiary care hospital; their knowledge on disease, treatments and complications. *Inter Jo Curr Res*. 2014;**07**:7487-7492.
26. Hui SS, Hui GP, Xie YJ. Association between Physical Activity Knowledge and Levels of Physical Activity in Chinese Adults with Type 2 Diabetes. *PLoS One*. 2014 Dec 10;**9**(12):e115098. doi: 10.1371/journal.pone.0115098. PMID: 25493559; PMCID: PMC4262475.
27. Ranasinghe P, Pigera AS, Ishara MH, Jayasekara LM, Jayawardena R, Katulanda P. Knowledge and perceptions about diet and physical activity among Sri Lankan adults with diabetes mellitus: a qualitative study. *BMC Public Health*. 2015 Nov 23;**15**:1160. doi: 10.1186/s12889-015-2518-3. PMID: 26597081; PMCID: PMC4657222.
28. Moodley LM, Rambiritch V. An assessment of the level of knowledge about diabetes mellitus among diabetic patients in a primary healthcare setting. *SA Fam Pract*. 2007;**49**(10):16. <https://doi.org/10.1080/20786204.2007.10873652>